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that said applicant has familiarized himself with the requirements of this act, a copy of which sworn statement shall be forwarded to the _____ (State department of health).

SEC. 15. Each and every person engaged in the practice of medicine or treating in any manner persons afflicted with disease shall display in a prominent place in his or her office a card upon which sections 2, 3, 4, 7, 13, 14, and 15 of this act have been printed with type not smaller than ten-point. A similar card shall be displayed in a prominent place in the office of each and every hospital, asylum, or other public or private institution for the treatment of the sick. These cards shall each be not less than 1 square foot in size and shall be furnished to institutions and licensed physicians and other persons treating the sick without cost by the _____ (State department of health).

SEC. 16. The sum of _____ dollars is hereby appropriated from any money in the State treasury not otherwise appropriated for carrying out the provisions of this act.

SEC. 17. This act shall take effect immediately, and all acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

ZOOPARASITIC INTESTINAL INFECTIONS.

AN ANALYSIS OF INFECTIONS FOUND AMONG 1,287 SCHOOL CHILDREN (776 WHITE, 511 NEGRO) OF THE CITY OF X.

By C. W. STILES, Professor of Zoology, United States Public Health Service.

The city of X. is located in the coastal area of one of the Gulf-Atlantic States and has a population of about 30,000 inhabitants, among whom the whites outnumber the negroes. Part of the homes have sewer connections; part of them have either surface or can privies.

Through the courtesy of the board of education and the parents of the school children, I have recently been able to examine nearly all of the pupils (both the white and the negro) in the city. The results of some of the examinations will be published in a series of short articles, each article dealing with a distinct phase of the studies.

White Pupils.

Of the total of 2,448 white pupils (1,189 boys, 1,259 girls), of 6 to 17.75 years old, inclusive, who gave data of one kind or another, 495 (225 boys, 270 girls) lived at homes provided with privies (group P); 1,783 (855 boys, 928 girls) lived at homes provided with sewer connections but without privies (group S); and 170 (109 boys, 61 girls) lived at homes in respect to which data regarding this phase of sanitation are not stated (group U).

Most of the "privy homes" had no sewer connection, but in some instances there was sewer connection for the family toilet and a privy for the negro servants. All homes of this type are here classified as "privy homes," since the families were, of course, subject to the influence of the servants' privies.

TABLE 1.—*Table of intestinal parasites found among the school children of the city of X.*

WHITE (6 TO 17.75 YEARS, INCLUSIVE).

	Persons negative.		Persons infected.		Percentage of persons found infected with parasites.																Infections not necessarily due to swallowing human excrement.				
	Number.	Per cent.	Total number.	Per cent.	Infections due solely to swallowing human excrement.																				
					Total.		Endameeba.		Lamblia.		Tricho- monas.		Ascaris.		Oxyuris.		Trichuris.		Total.						Hymen- stoma.
Number of persons examined.					Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	Number persons.	Per cent.	
Girls:																									
Privies.....	63	38	60.32	25	39.68	15	23.81	2	3.17	9	14.28														
Sewers.....	258	196	75.97	62	24.03	48	18.60	20	7.75	17	6.53	4	6.34												
Uncertain....	9	7	77.78	2	22.22	2	100.00			1	0.39	8	3.10	2	0.77	1	0.39	16	6.20	1	0.39	15	5.81		
Total.....	330	241	73.03	89	26.97	65	19.70	22	6.67	28	8.45	1	3.0	12	3.64	2	.69	20	8.79	1	.30	28	8.48		
Boys:																									
Privies.....	63	25	39.68	38	60.32	25	39.68	8	12.70	10	15.87	2	3.17	7	11.11										
Sewers.....	333	208	62.92	145	43.08	116	32.86	34	8.63	56	13.86	36	10.20	3	0.97										
Uncertain....	30	17	56.67	13	43.33	12	40.00	4	13.33	5	23.41														
Total.....	446	250	56.05	196	43.95	153	34.30	46	10.31	71	15.92	4	9.0	46	10.31	1	.22	9	2.02	56	12.56	1	.22	55	12.33
Total (girls and boys):																									
Privies.....	126	63	50.00	40	31.75	10	7.94	19	15.08																
Sewers.....	611	404	66.10	207	33.88	164	26.84	54	8.84	73	11.95	3	4.9	44	6.12	2	.33	31	24.60	31	24.60	31	24.60		
Uncertain....	39	24	61.53	15	38.46	14	35.90	4	10.26	7	17.95			3	7.69	1	2.56	2	5.12	2	5.12	2	5.12		
Total.....	776	491	63.27	285	36.73	218	28.09	68	8.76	99	12.75	5	6.4	58	7.47	3	.39	10	1.23	85	10.96	2	.26	83	10.69

The classification here adopted represents not only the environmental sanitation (as respects the disposal of human excrement) under which the children live, but it also represents (to a considerable degree, but with certain exceptions) the general economic status of the families. A family in better economic status is, of course, more likely to have sewer connection for the home than is a family in less favorable economic status, provided the house is located in the sewered portion of the city. On the other hand, the classification does not represent the economic status of the well-to-do families who live in nonsewered portions of the city and of families who have sewer connection for the family, but a privy for the servants. These important exceptions must be constantly held in mind in connection with all of the deductions obtained.

Further, it is well to recall that the general economic status influences questions of food, home training, and advantages of various kinds, and that, therefore, the presence or absence of a privy at the home is not the only factor that comes into consideration in influencing the child. For instance, a child may live at a sewered home, but he may live within the radius of influence of the privy located at some neighbor's home (perhaps on the street back of the sewered home); further, the child at the sewered home may have, because of better economic status, better medical attention, etc.

With the distinct reservation, therefore, that the sewer or privy at a given home is not the only factor that comes into consideration in these studies, children will be divided into three general classes as expressed by the privy homes (group P), sewered homes (without privy) (group S), and uncertain homes (in regard to which data on this point are lacking) (group U), in order to see whether differences are present between children (of group P) who live at privy homes and children (of group S) who live at sewered homes (without privy), and if so, what these differences are.

Of the total 2,448 white pupils, 776 (446 boys, 330 girls) submitted fecal specimens for microscopic examination. These represent 31.7 per cent of the total number (37.51 per cent of the boys, 26.21 per cent of the girls); 25.45 per cent of the total (28 per cent of the boys, 23.33 per cent of the girls) belonging to group P (living at privy homes), 34.26 per cent of the total (41.29 per cent boys, 27.80 per cent of the girls) belonging to group S (living at sewered homes), and 22.94 per cent of the total (27.52 per cent of the boys, 14.75 per cent of the girls) belonging to group U make up the 776 pupils who submitted specimens. Thus the results for all male groups are more representative than for the corresponding female groups, the results for group P (from the privy homes) are more complete than those for group S (from the sewered homes), and the results for group U are the

least complete of any of the groups. Taking the groups P and S (privy homes and the sewered homes), it is seen that in all cases (except girls of group S) the figures represent more than one-fourth of all the children in their respective groups.

Of the total 776 pupils (446 boys, 330 girls) who furnished specimens, a total of 491 (63.27 per cent) (250 boys, 56.05 per cent, and 241 girls, 73.03 per cent) showed no infection with intestinal protozoa, or worms, while a total of 285 (36.73 per cent) (196 boys, 43.95 per cent; 89 girls, 26.97 per cent) showed infection. Thus it is seen that the infection among the boys (43.95 per cent) was distinctly higher than that (26.97 per cent) among the girls.

Following the statistics for the known privy and known sewered homes, it is seen that of a total of 126 group P children (63 boys, 63 girls), a total of 63 pupils (50 per cent) (38 boys, 60.32 per cent; 25 girls, 39.68 per cent) showed infection, while of a total of 611 group S pupils (353 boys, 258 girls), a total of 207 pupils (33.88 per cent) (145 boys, 41.08 per cent; 62 girls, 24.03 per cent) showed infection. Thus it is clear that, taking either the boys or the girls, or both together, the children of group P are less protected against these infections than are those of group S. Further, since the fecal material is usually carried away immediately from sewered homes, it is clear that certainly in most cases the children of group S, who showed infection, obtained their parasites either when away from their homes or because their homes were within the radius of influence of their neighbors' privies (white or negro), or through food or drink infected before it was brought to their homes. In other words, when a man introduces sewer connection at his home he protects his family to a certain extent, but this protection is not complete until the same sanitation is installed at his neighbors' houses nor until the places from which he draws his food supplies are properly sanitized. Thus, the conclusion is inevitable that the sanitary duty of the head of a family does not end with the borders of his premises.

Unconscious coprophagia.—The parasites found may be classified in two larger biological groups, from the standpoint of method of infection.

Infections with certain protozoa (*Endamoeba*, *Lambliia*, *Trichomonas*) and round worms (*Ascaris* or the eel worm, *Oxyuris* or the pin worm, and *Trichuris* or the whip worm) are contracted by swallowing the germs contained in human excrement, and in no other way.

These germs, which are spread by permitting the excrement to be disseminated by flies, by dogs, by chickens, etc., finally reach the mouth through infected food, infected water, soiled fingers, or by putting into the mouth other objects soiled by the scattered excreta.

Infections with *Necator* (hookworms) can be contracted through the skin, as well as by mouth; while the infection with the dwarf tapeworm (*Hymenolepis nana*) is probably contracted only through the mouth, it is possibly still an open question whether this is done by swallowing human excrement containing the eggs, or by swallowing an insect that acts as intermediate host.

Of the total 776 children examined, a total of 218 (28.09 per cent) (153 boys, 34.30 per cent; 65 girls, 19.70 per cent) clearly obtained infections by swallowing human excrement.

These figures indicate that white boys swallow more human excrement than do white girls, and if the statistics are studied for double and triple infections in boys as compared with girls, this conclusion is more than confirmed (total 177 infections in 446 boys as compared with 66 infections in 330 girls).

Moreover, the proof is present that these 218 children obtained a total of 243 infections in this manner, as compared with 85 infections which they might have obtained in some other way.

All of the 328 infections in 285 of the 776 children examined are traceable directly to the fact that in the surroundings in which the school children have been living, or by which their life is influenced, human excrement has not been disposed of in a safe and proper manner, but has been permitted to come into contact with their bodies and with their food and drink.

Comparing next the children of groups P and S, from a standpoint of coprophagia, it is seen that of the total 126 children of group P (63 boys, 63 girls), a total of 40 pupils (31.75 per cent) (25 boys, 39.68 per cent; 15 girls, 23.81 per cent) were proved to have swallowed human excrement one or more times, while of the total of 611 children of group S (353 boys, 258 girls) a total of 164 pupils (26.84 per cent) (116 boys, 32.86 per cent; 48 girls, 18.60 per cent) gave the same proof. Thus it is clear that coprophagia is more common among white children living at homes provided with a privy than among those at sewerer homes (without a privy) and that this conclusion holds for the boys, for the girls, and for the two combined.

As the boys of group S show a greater incidence (32.86 per cent) of coprophagia than that (23.81 per cent) shown by the girls of group P, it would appear that a considerable amount of this infection is obtained elsewhere than at the home table, for the chances of infection at the home table are certainly greater for girls of group P than for boys of group S. The conclusion would seem to be justified that white girls of group P are more cleanly in their habits than are boys of group S.

If the statistics for the separate species of parasites be studied for the various groups and subgroups of children, it is seen that the figures become so small as to render conclusions of very little—in fact, questionable—value. It will be well, however, to place them

on record as they will be of use in accumulating facts of this nature. The details may be seen from the table (p. 1992).

It will be noticed that the total infection with *Endamoeba coli* was 0.9 per cent greater at sewered homes than at privy homes.

With *Lambli*a, the total infection was 3.13 per cent greater at privy homes than at sewered homes.

With *Trichomonas*, the infection was 1.10 per cent greater at privy homes than at sewered homes.

With *Ascaris lumbricoides*, the infection was 2.61 per cent greater at privy homes than at sewered homes.

With *Oxyuris vermicularis*, the infection was 0.33 per cent greater at sewered homes than at privy homes.

With *Trichuris trichiura*, the infection was 1.56 per cent greater at privy homes than at sewered homes.

Infections not necessarily obtained through coprophagia.—Only two children showed infection with the dwarf tapeworm, *Hymenolepis nana*. Both of these pupils live at sewered homes.

Of the total 776 children examined, 83 pupils (10.69 per cent) showed infection with hookworms. Despite the fact that these are city school children, this infection is greater than that shown by the rural school children in some of the clay-land counties.

Of the total 126 children of group P (63 boys, 63 girls), a total of 31 pupils (24.60 per cent) (18 boys, 28.57 per cent, 13 girls, 20.63 per cent) showed hookworm infection; of the total 611 children of group S (353 boys, 258 girls), a total of 50 pupils (8.18 per cent) (35 boys, 9.91 per cent; 15 girls, 5.81 per cent) showed hookworms. Thus it is clear that the hookworm infection was approximately three times as great among the children of group P as among the children of group S, and this holds for the boys, the girls, and for both combined.

It is scarcely to be assumed that all of these hookworm children became infected at their homes. Some of them doubtless obtained the infection at their neighbors, some out in the rural districts. Nevertheless, the percentage preponderance of hookworm children at privy homes is very striking, and since hookworm infection may be a retarding influence in both physical and mental development, we must not be surprised if the tabulations show that the hookworm children affect the averages of the children of group P in some of the physical and mental tests that were made.

Multiple infections.—In 39 children (33 boys, 6 girls) double infections were found; in 3 children (all boys) triple infections were found. The number of triple infections is too low to use statistically. The number of double infections is also rather low for statistical use, but it may be remarked that 9.5 per cent of the children of group P showed double infections as compared with 3.8 per cent of the children of group S.

Negro Pupils.

It was much more difficult to obtain definite ages for the negroes than for the whites, and a much larger percentage of the negro children had to be rejected because of this fact. Any classification of a large number of negro children on age basis can at present be only approximate. Accordingly, the negro pupils included in this tabulation correspond only approximately to the white pupils, namely, 6 to 18 years old, inclusive, and one additional year (18 years old) is inserted for the negroes in order partially to balance the inaccurate data regarding age.

Of a total of 1,346 negro pupils (538 boys, 808 girls), of approximately 6 to 17.75 years old, inclusive, who gave data of one kind or another, 1,029 (414 boys, 615 girls) lived at homes provided with privies (group P), 178 (60 boys, 118 girls) lived at homes provided with sewer connections but without privies (group S), and 139 (64 boys, 75 girls) lived at homes in respect to which data regarding this phase of sanitation are lacking (group U).

Of the total 1,346 negro pupils, 511 (226 boys, 285 girls) submitted specimens for microscopic examination. These represent 37.96 per cent of the total number (42.01 per cent of the boys, 35.27 per cent of the girls); 42.95 per cent of the total (48.79 per cent of the boys, 39.02 per cent of the girls) who lived at privy homes (group P) and 38.76 per cent of the total (40 per cent of the boys, 38.13 per cent of the girls) who lived at sewered homes (group S) make up the total of 511 who submitted specimens. No negro group falls below 35 per cent of the children of its group.

Of the total 511 negro pupils (226 boys, 285 girls) who furnished specimens, a total of 260 (50.88 per cent) (117 boys, 51.77 per cent, and 143 girls, 50.18 per cent) showed no infection with intestinal protozoa or worms, while a total of 251 (49.12 per cent) (109 boys, 48.23 per cent, and 142 girls, 49.82 per cent) showed infection.

Of the total 442 negro children of group P (202 boys, 240 girls) examined, a total of 223 (50.45 per cent) (101 boys, 50 per cent, and 122 girls, 50.83 per cent) showed infections, while of the total of 69 negro children of group S (24 boys, 45 girls) examined, a total of 28 (40.58 per cent) (8 boys, 33.33 per cent, and 20 girls, 44.44 per cent) showed infection. Thus it is clear that, taking either the boys or the girls or both together, the children of group P are less protected against these infections than are the children of group S. Further, the infection among the negro girls was slightly higher than that among the negro boys.

In interpreting these percentages it should be held in mind that the differences in some instances are very slight.

Unconscious coprophagia.—Of the total 511 negro children examined, a total of 246 (48.14 per cent) (107 boys, 47.34 per cent, and 139 girls, 48.77 per cent) clearly obtained infections from swallowing human excrement. The difference between the boys and girls is less than 1 per cent and indicates that negro boys and negro girls are practically equal in this respect.

Moreover, the proof is present that these 246 negro children obtained 296 infections in this way, as compared with 18 infections which they might have obtained in some other manner.

Comparing next the negro children of group P with those of group S, from a standpoint of coprophagia, it is seen that of a total of 442 children of group P (202 boys, 240 girls), a total of 218 pupils (49.32 per cent) (99 boys, 49.10 per cent, and 119 girls, 49.58 per cent) were proved to have swallowed human excrement one or more times, while of a total of 69 pupils of group S (24 boys, 45 girls), a total of 28 (40.58 per cent) (8 boys, 33.33 per cent; 20 girls, 44.44 per cent) gave the same proof. Thus it is clear that coprophagia is more common among negro children living at homes provided with a privy than among those at sewerred homes (without a privy) and that this conclusion holds for the boys, for the girls, and for the two sexes combined.

The statistics for the separate species of parasites reduce some of the groups to rather small figures, but the following facts may be noticed:

Endamoeba coli was present more frequently (by 4.63 per cent) among children of group S than among children of group P.

*Lambli*a was present more frequently (by 2.45 per cent) at privy homes than at sewerred homes.

Ascaris lumbricoides was present more frequently (by 8.89 per cent) at privy homes than at sewerred homes.

Trichuris was present in practically the same proportion at sewerred homes and at privy homes.

Infections not necessarily obtained through coprophagia.—*Hymenolepis nana* was found only once.

Hookworms were found only 17 times and in slightly greater frequency (by 1.18 per cent) at the sewerred homes.

Multiple infections.—In 52 children (21 boys, 31 girls) double infections were found; in 4 children (2 boys, 2 girls) triple infections were found; in 1 girl quadruple infection was found. The triple and quadruple infections are too few to be used statistically. The number of double infections is also rather low for statistical comparison, but it may be remarked that double infections were present in 9.72 per cent of the children of group P, as compared with 13.44 per cent of the children of group S.

General Discussion with Comparison of White and Negro Children.

It is a matter of common knowledge that the white families live in better sanitary environment than do the negroes. This condition is due to a better economic status, to better education, and to higher standards. This common knowledge is reduced to a statistical basis in the present study, which shows that 20.22 per cent of the white pupils of the city of X live at privy homes, as compared with 76.46 per cent of the negro pupils.

Popular opinion is to the effect that it is more difficult to obtain cooperation in health matters from the negroes than it is from the whites. This popular view is not entirely in accord with my personal experience on a number of occasions, and in this particular study the statistics indicate that a better response was obtained from the negroes than from the whites, as indicated by the fact that 37.96 per cent of the negro children furnished specimens as compared with 31.7 per cent of the white children. This indication is subject to the criticism that a greater proportion of negro children than of white children were eliminated from consideration because of the indefiniteness of their age. Undoubtedly the white children, especially the girls, are more influenced by a feeling of modesty than are the negro children, when it comes to submitting specimens for examination. Nevertheless, it is well to recall that, notwithstanding the greater proportion of ignorance among the negroes, it is by no means so hopeless a matter to obtain their cooperation in a public-health movement as is frequently supposed. Results will vary with conditions and in different localities, but they will vary especially with the methods adopted by the person who is seeking to enlist their interest.

Corresponding to the poorer grade of sanitary environment under which the negroes live, as compared with the whites, and corresponding to their lower standards in general, theory indicates that they may be expected to show a higher incidence of infection with certain species of intestinal parasites. The present studies tend to confirm this expectation, as is seen from the statistics of 49.12 per cent of the negroes, as compared with 36.73 per cent of the whites, for total number of pupils infected, and 48.14 per cent of the negroes, as compared with 28.09 per cent for the whites, as index of infections that could have been obtained only by the actual swallowing of human excrement, and in no other way. Further, as the statistics for the children of group P (of both races) are compared with those for the children of group S, it is seen that for all corresponding groups and subgroups the children of group P swallow more human excrement than do the children of group S, but the point is instructive that white boys of group S swallow more of this filth than do white girls of group P.

The fact that negro servants prepare most of the food for the whites who can afford servants is, when taken into consideration with these statistics, a matter for serious reflection. As the negroes are more coprophagous than are the whites, in great degree at least because of their poorer sanitary environment, they would seem to be, theoretically, more likely to be temporary or permanent typhoid carriers; and in their capacity as food preparers they would seem, theoretically, to present the greater possibilities of typhoid infection in a community through carriers.

Accordingly, an improvement of the sanitary environment of the negro appears prerequisite to the permanent reduction of typhoid infection due to carriers.

Comparing the parasites obtained through unconscious coprophagia, it may be noted that in these examinations, *Endamoeba coli*, *Ascaris lumbricoides*, and *Trichuris trichiura* were found more frequently in negroes than in whites, while *Lamblia*, *Trichomonas*, and *Oxyuris* were found more frequently among the whites.

The infections with parasites that might be obtained in other ways than by coprophagia were distinctly more common among the whites than among the negroes. This was due to the much larger percentage of hookworms among the white boys and girls. To what extent this fact is to be explained by a comparison of the thickness of the skin and the odor of the feet of the whites and negroes is a matter of speculation, but the conclusion seems plausible that these factors come into consideration.

The general practical conclusions to be drawn from this study are clear, namely:

(1) There is a vast amount of unconscious coprophagia occurring in human beings.

(2) This varies to an appreciable extent, in one and the same town, being less among people living at homes provided with a sewer than at homes provided with a privy, but the variation is not mathematically proportional to the number of sewer connections.

(3) While part of this coprophagia is, without doubt, due to the fact that flies carry the filth to the food, and while part is, without reasonable doubt, due to infection of food soiled by persons who prepare food, it is impossible to estimate the ratios of these two sources.

(4) Part of this coprophagia is undoubtedly due to the personal daily habits (of play, etc.), of the children, and the percentages would seem to indicate that there is a greater difference in this respect between the white girls and the white boys than there is between the negro girls and the negro boys.

(5) All of this unconscious coprophagia clearly demonstrates that in the environment which influences the lives of these children (includ-

